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$$\therefore \sec \beta = \frac{e[\sqrt{(2e^2-1)}-1]}{e^2-1}. \quad \therefore \frac{e\sqrt{(2)}[\sqrt{(2e^2-1)}-1]}{2(e^2-1)} \text{ is semi-major axis.}$$

$$\therefore \text{average volume is } \frac{1}{2}e\left(\frac{e\sqrt{(2)}[\sqrt{(2e^2-1)}-1]}{2(e^2-1)} + \frac{1}{2}\right)\pi = \Delta.$$

$$\therefore \Delta = \frac{\pi e}{8(e^2-1)}[e\sqrt{2(\sqrt{2e^2-1}-1)}+e^2-1]=5.4345 \text{ cubic inches, when } e=5 \text{ inches.}$$

72. Proposed by B. F. FINKEL, A. M., M. Sc., Professor of Mathematics and Physics, Drury College, Springfield, Mo.

A rod is broken at random into four pieces; find the chance that no one of the pieces is greater than the sum of the other three. [From *C. Smith's Treatise on Algebra*, p. 528.]

Solution by G. B. M. ZERR, A. M., Ph. D., Professor of Mathematics and Science, Chester High School, Chester, Pa.

Let a = length of rod.

By conditions of problem no part can be greater than $\frac{1}{2}a$.

Let $ABCD-G$ be a cube side a .

Let $Abcd-g$ be a cube side $\frac{1}{2}a$.

For favorable cases the points are confined to the smaller cube.

$$\therefore \text{chance} = \frac{(\frac{1}{2}a)(\frac{1}{2}a)(\frac{1}{2}a)}{(a)(a)(a)} = \frac{1}{8}.$$

73. Proposed by G. B. M. ZERR, A. M., Ph. D., Professor of Mathematics and Science, Chester High School, Chester, Pa.

On an average 1 vessel out of every n is wrecked. Find the chance that out of m vessels expected p at least will arrive safely.

I. Solution by the PROPOSER.

The chance of a vessel arriving is $[(n-1)/n]$.

The chance of a vessel not arriving is $1/n$.

The event will happen if, m , $(m-1)$, $(m-2)$, $(m-3)$, $(m-4)$, down to p vessels arrive.

Thus the required chance is the sum of the first $(m-p+1)$ terms in the expansion of

$$\begin{aligned} \left(\frac{n-1}{n} + \frac{1}{n}\right)^m &= \left(\frac{n-1}{n}\right)^m + \frac{m}{1}\left(\frac{1}{n}\right)\left(\frac{n-1}{n}\right)^{m-1} + \frac{m(m-1)}{2!}\left(\frac{1}{n}\right)^2\left(\frac{n-1}{n}\right)^{m-2} \\ &+ \dots + \frac{m!}{p!(m-p)!}\left(\frac{1}{n}\right)^{m-p}\left(\frac{n-1}{n}\right)^p. \end{aligned}$$

$$\begin{aligned} \text{If } n=10, m=5, p=3, \text{ we get chance} &= \binom{9}{10}^5 + 5\binom{1}{10}\binom{9}{10}^4 + 10\binom{1}{10}^2\binom{9}{10}^3 \\ &= \frac{12303}{100000}. \end{aligned}$$